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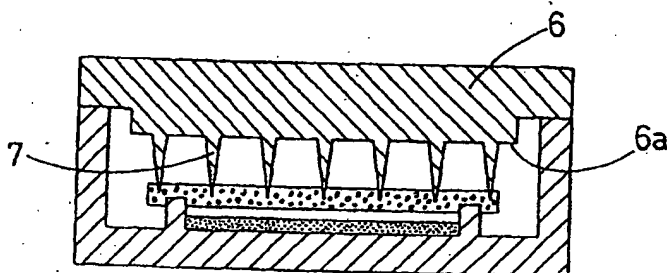
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(54) **Injection moulding method for EVA-soles, having a treading surface with coloured sections**

(57) This invention concerns an injection moulding process for soles having a coloured treading surface produced with expansible and cross-linking "EVA" compounds involving the use of coloured inserts (5) mould-

ed with the same moulding material used for sole, but of a different colour, fed into cups (4) on the bottom of the mould impression and shut by caps (8) also moulded in the same material used to mould the soles.



**FIG. 4**

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## Description

This patent application concerns an injection moulding method for soles having a treading surface with coloured sections, and produced with expansible and cross-linking "EVA" compounds.

The patent protection is also extended to the sole obtained with the method according to the invention.

The abbreviation "EVA" refers to "vinyl-acetate ethylene copolymer" which, according to the type of additive used, may be thermoplastic or expansible and cross-linking.

In the case of the latter type, an expanding powder additive is used which decomposes at a specific temperature to produce gases which give rise to a typical phenomenon which occurs in injection moulding using this type of "EVA", consisting of the instantaneous expansion of the part as soon as the mould is opened.

In particular the dimensions of the part increase rapidly while the proportions and shape remain unaltered thus maintaining a ratio of perfect similarity with respect to the impression of the matrix.

Expansible and cross-linking "EVA", thanks above all to its low cost, is widely used in the footwear sector for the production of inexpensive injection moulded soles.

To date it has not been possible to produce injection moulded soles in expansible and cross-linking "EVA" compounds, having a treading surface with one or more different coloured sections with respect to the sole; in fact, this can only be achieved by painting the single-colour sole after moulding.

The purpose of this invention is to design a method which makes it possible to obtain during the same moulding stage, a sole whose treading surface has different coloured sections with respect to the colour of the sole, in order to cut the costs currently sustained to paint the sole after moulding.

The method in question is based on the idea of equipping the sole mould with one or more inserts premoulded in the same material used to mould the sole but of a different colour; the inserts are moulded by heating the expansible and cross-linking "EVA" compound granules to melting point without reaching the higher temperature which triggers the cross-linking and decomposition process of the expanding fillers.

The method in question also involves the use of a special mould which, on one hand, ensures that the inserts pre-mounted during the injection stage are securely fixed, and on the other prevents mixing, along the edge of the inserts, between the moulding material of the sole and that of the inserts, which would produce unattractive streaks or stains of different shades of colour with respect to the colours of the two materials.

It is important to consider in fact that the granules of the "EVA" based compound are heated to melting point before being injected into the mould, in which the inserts also reach melting temperature, so that one of

the most difficult problems resolved was in fact that of avoiding with absolutely security the possibility that streaks or halos of different shades would appear on the treading surface due to the mixing of different coloured molten "EVA" granules.

In order to resolve this problem, the method according to the invention entails the use of a special mould with an impression having the same number of annular ribs on its bottom wall as the coloured inserts which are pre-fitted on the mould and which are housed precisely in the cup delimited by each of said annular ribs.

According to the method in question, once each of the cups has been mounted with its respective insert, the cup is shut with a sealing cap consisting of a shaped pad premoulded in the same material as the sole, which is however heated to melting point without attaining the cross-linking and decomposition temperature of the expansion fillers, as previously mentioned for moulding of the inserts.

Each cap is fixed to its respective cup by means of a series of closely packed rods projecting from the internal surface of the cover which shuts the mould matrix.

When the cover of the mould is shut over the matrix, said rods penetrate into said caps, which are thus held securely over the cups even during the injection phase, despite the fact that the flow of liquid enters the mould at a very high pressure.

Moreover, the seal ensured by said caps together with the annular ribs on the bottom of the matrix impression, exclude any possible mixing between the fluid mass injected into the mould and that of the inserts which melt in their respective cups.

For major clarity the description of the process continues with reference to the enclosed drawings which are intended for purposes of illustration and not in a limiting sense, where:

- Fig. 1 shows the open mould cross-sectioned with a transversal plane of its impression;
- Fig. 2 is similar to fig. 1 with the addition of an insert mounted in the impression of the mould;
- Fig. 3 is similar to fig. 2 with the addition of the cap which shuts the cup housing the insert;
- Fig. 4 is similar to fig. 3 with the addition of the mould cover;
- Fig. 5 shows the treading surface of a sole realised using the method according to the invention;
- Fig. 6 is a cross-section of the sole in Fig. 5 with the transversal plane VI-VI of fig. 5.

The method according to the invention entails the use of a special mould (1) having an impression (2) with the same number of annular ribs (3) on its bottom wall (2a) delimiting the same number of cups (4) conforming exactly to the coloured inserts (5) pre-mounted on the mould (1); the cover (6) of mould (1) having in proximity of each of the cups (4), a series of closely packed rods (7) projecting from its internal surface (6a).

The method according to the invention also involves the use of inserts (5) consisting of plates moulded in the same materials used to mould the sole, but of a different colour; said inserts (5) being moulded by heating the granules of expanding and cross-linking "EVA" based compound to melting point, without however reaching the higher temperature which triggers the cross-linking and decomposition of the expanding fillers.

The method according to the invention also entails the use of caps (8) which shut said cups (4), consisting of pads moulded in the same material used to mould the sole; the caps (8) being moulded by heating the granules of expanding and cross-linking "EVA" based compound to melting point, without however reaching the higher temperature which triggers the cross-linking and decomposition of the expanding fillers.

In particular, said caps (8) are provided on their bottom surface with a perimeter groove (8a) designed to couple precisely with the annular rib (3) delimiting each cup (4) housing the inserts (5).

In order to ensure said coupling, the thickness of the coloured inserts (5) is inferior to the height of the annular ribs (3).

In consideration of the foregoing, the method according to the invention provides that the moulding phase of the sole occurs as follows:

- a) - fitting onto the mould (1) of the inserts (5), each of which is housed into a corresponding cup (4);
- b) - fitting onto the mould (1) of the caps (8), each of which is housed above a corresponding cup (4) so as to ensure coupling between the perimeter groove (8a) of the cap (8) and the rib (3) delimiting the cup (4);
- c) - closing of the mould;
- d) - injection of the moulding material;
- e) - opening of the mould after a time that ensures cross-linking and decomposition of the expanding fillers simultaneously in the injected mass, in the molten mass of the inserts (5) and in the molten mass of the caps (8).

As shown in figures 5 and 6, the sole (9) obtained with the method according to the invention is provided on its treading surface with one or more sections (10) of different colours with respect to that of the sole (9) delimited by a run (11) that corresponds to the impression produced by the annular rib (3) delimiting the cup (4) in which the insert (5) is fitted and from which each coloured section (10) is produced:

- the provision of shaped inserts (5) consisting of plates moulded with the same type of expanding and cross-linking "EVA" based compound used to mould the sole, but of a different colour, whose granules are heated to melting point without however reaching the higher temperature which triggers cross-linking and decomposition of the expanding fillers;
- provision and use of a special mould (1) whose impression (2) is provided on its bottom wall (2a) with the same number of annular ribs (3) delimiting the same number of cups (4) exactly conforming to the above coloured inserts (5), while the cover (6) of the mould (1) is provided on each of the cups (4) with a series of closely packed rods (7) projecting from its internal surface (6a);
- the provision of caps (8) which seal said cups (4), consisting of shaped pads moulded with the same expanding and cross-linking "EVA" based compound used to mould the sole, whose granules are heated to melting point without however attaining the higher temperature which triggers cross-linking and decomposition of the expanding fillers;
- fitting onto the mould (1) of the inserts (5), each of which is housed into its respective cup (4);
- fitting onto the mould (1) of the caps (8), each of which is housed above its corresponding cup (4);
- closing of the mould (1);
- injection of the moulding material into the mould (1);
- opening of the mould (1) after a time that ensures cross-linking and decomposition of the expanding fillers simultaneously in the injected mass, in the molten mass of the inserts (5) and in the molten mass of the caps (8).

2. A method according to the previous claim characterised by the provision of caps (8) to shut said cups (4) having a perimeter groove (8a) at the bottom which couples with the annular rib (3) of the cup (4) shut by the cap (8).
3. An injection moulded sole realised in expanding and cross-linking "EVA" based compound having coloured sections on its treading surface, and produced with the method described in the previous claims.

#### Claims

1. A method for injection moulding soles realised with expanding and cross-linking "EVA" based compounds having coloured sections on the treading surface, characterised by:

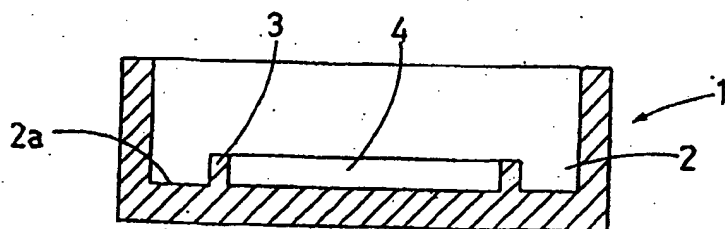


FIG. 1

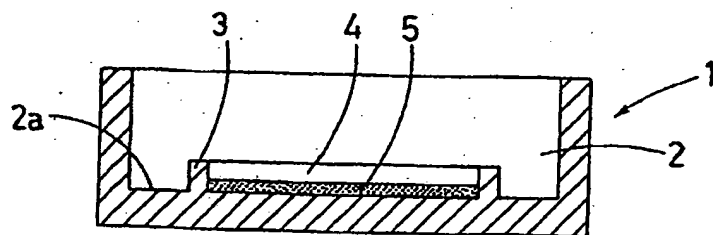


FIG. 2

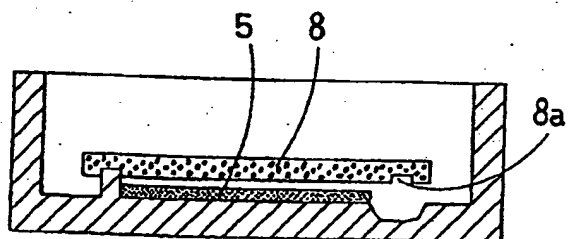


FIG. 3

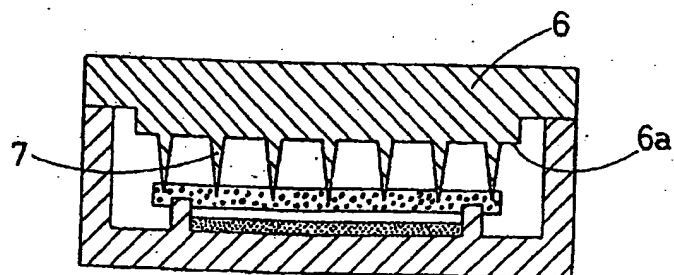


FIG. 4

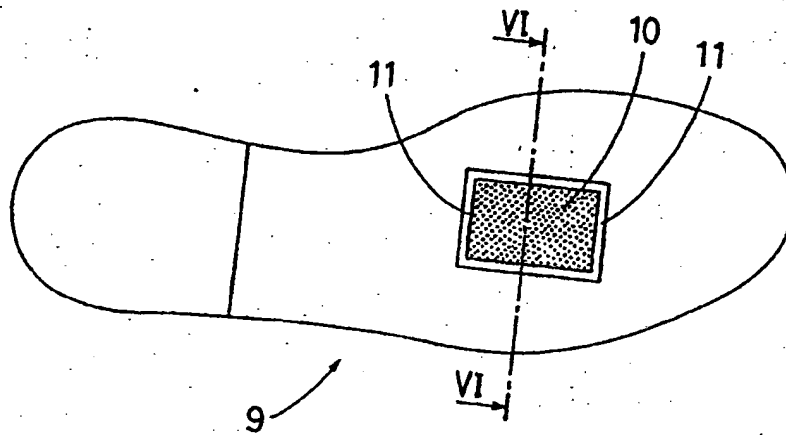


FIG. 5

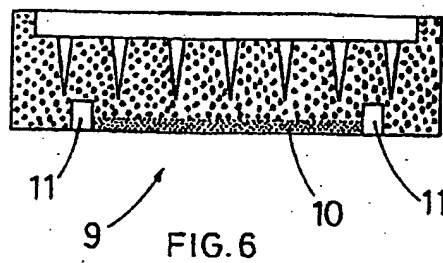


FIG. 6